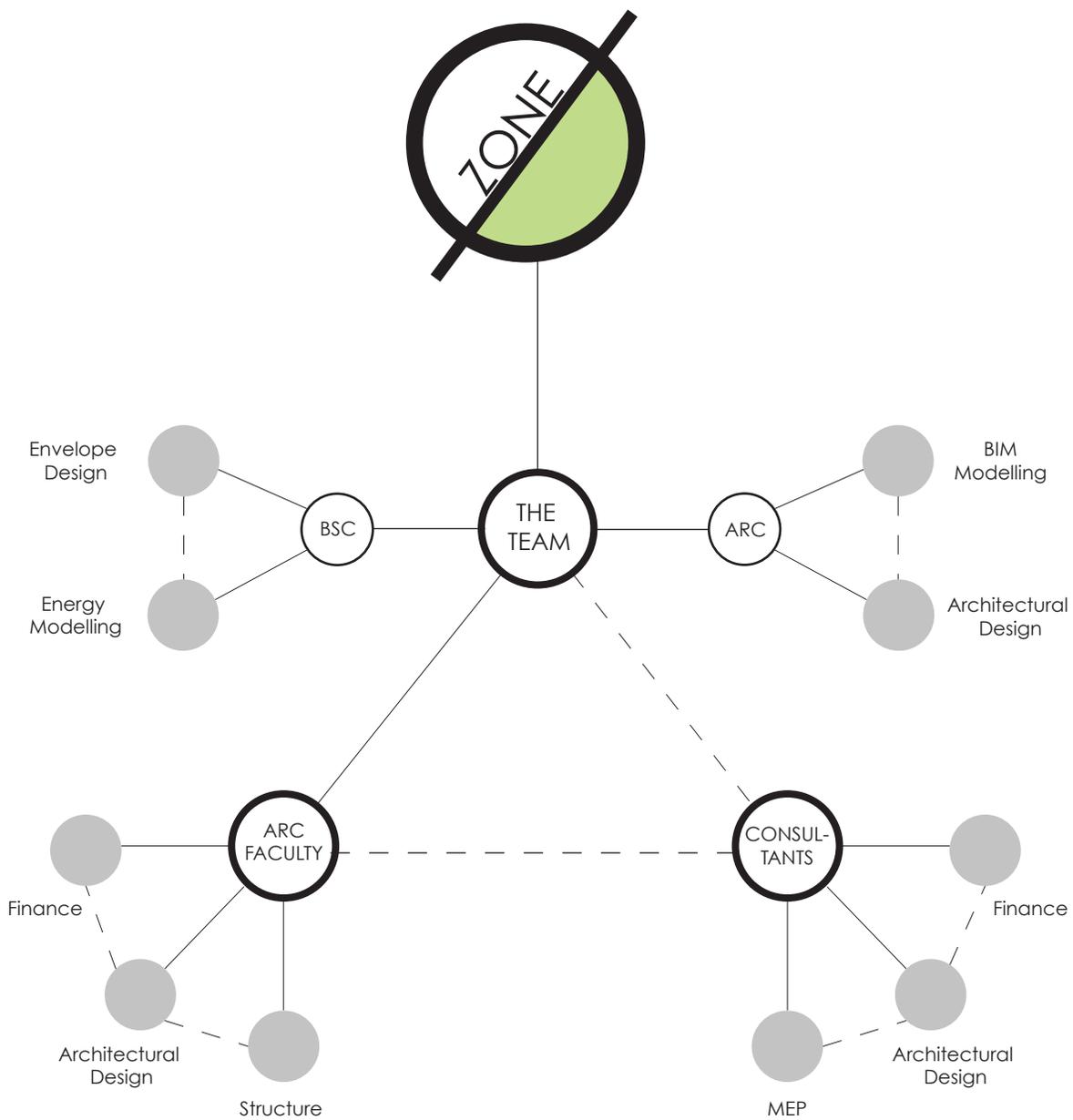




Ø - ZONE





Woodbine Beaches

CN Tower and Rogers Centre



974 Eastern Ave

Queen St E. and Leslie St. Junction

Ryerson University Campus





QUEEN ST EAST | TORONTO

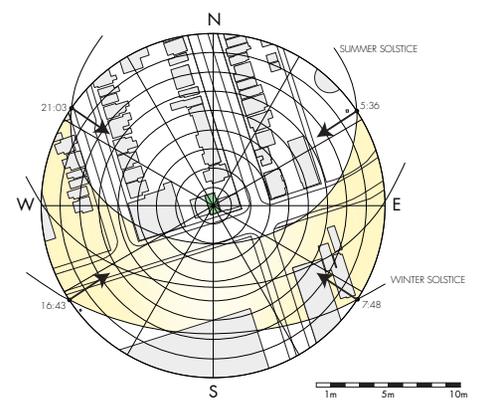
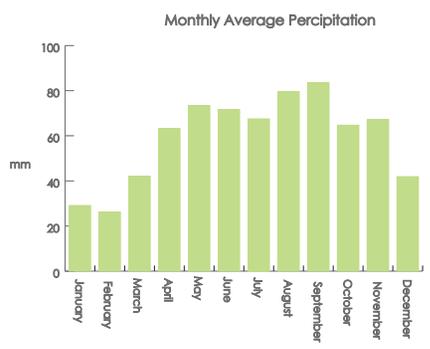
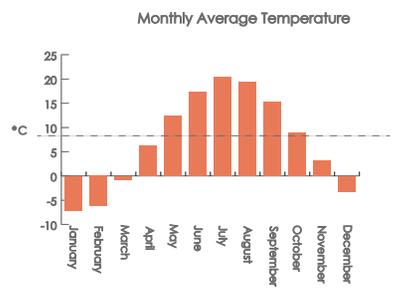
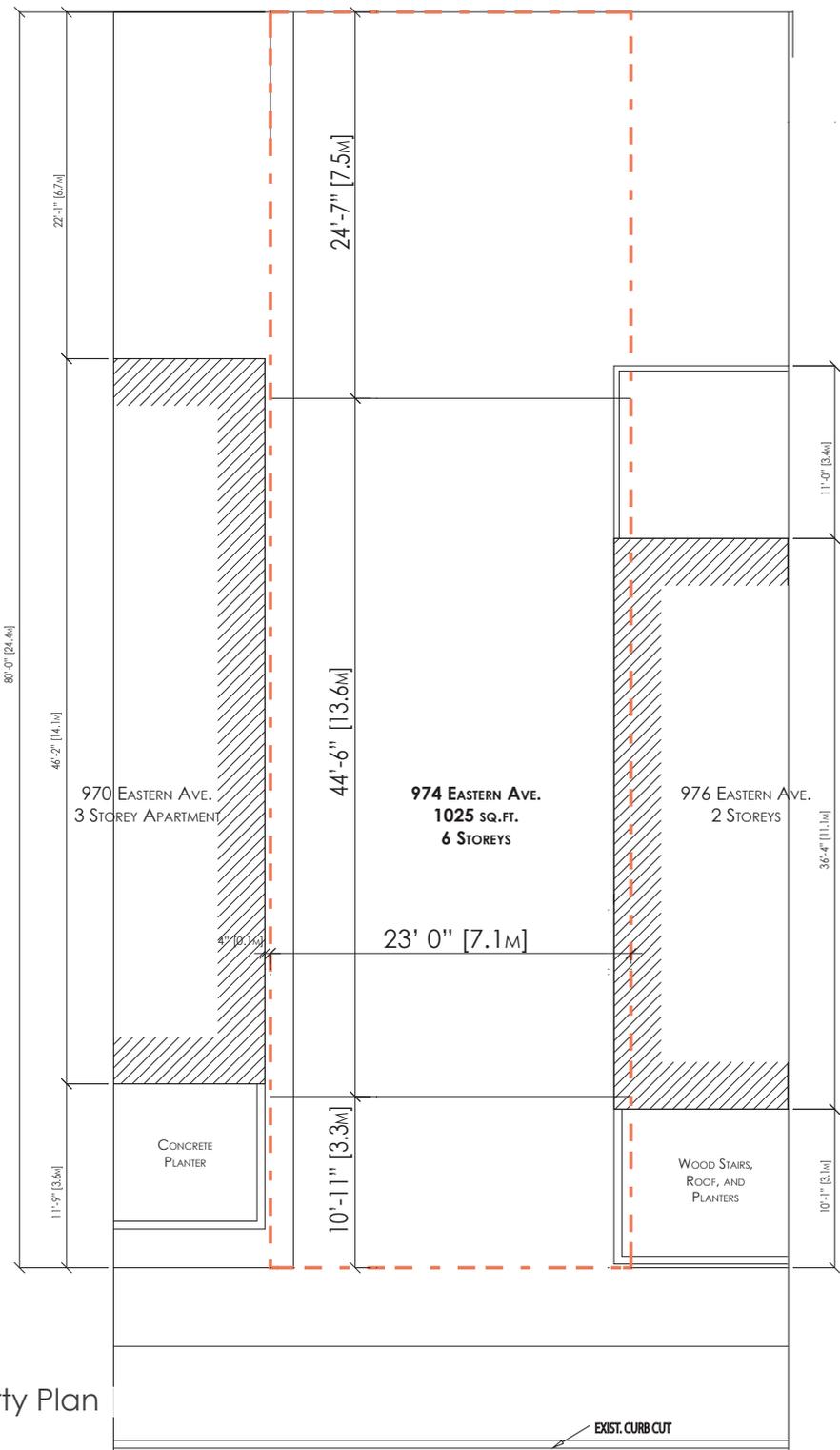


THE BEACHES | TORONTO



View from South Entrance

Property Plan





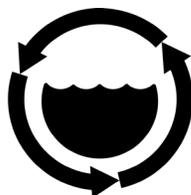
View from South Entrance



low carbon footprint



affordable



reuse energy



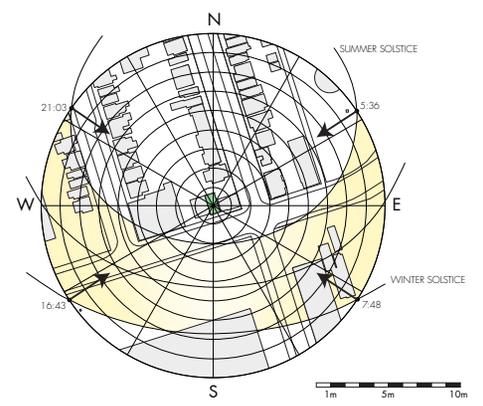
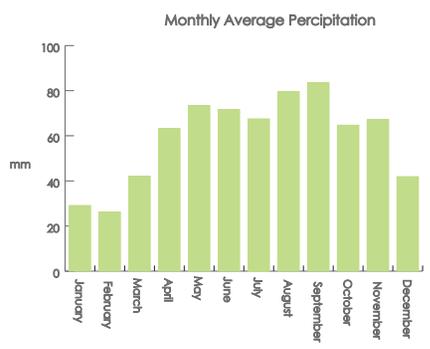
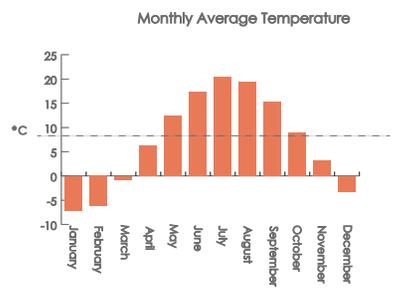
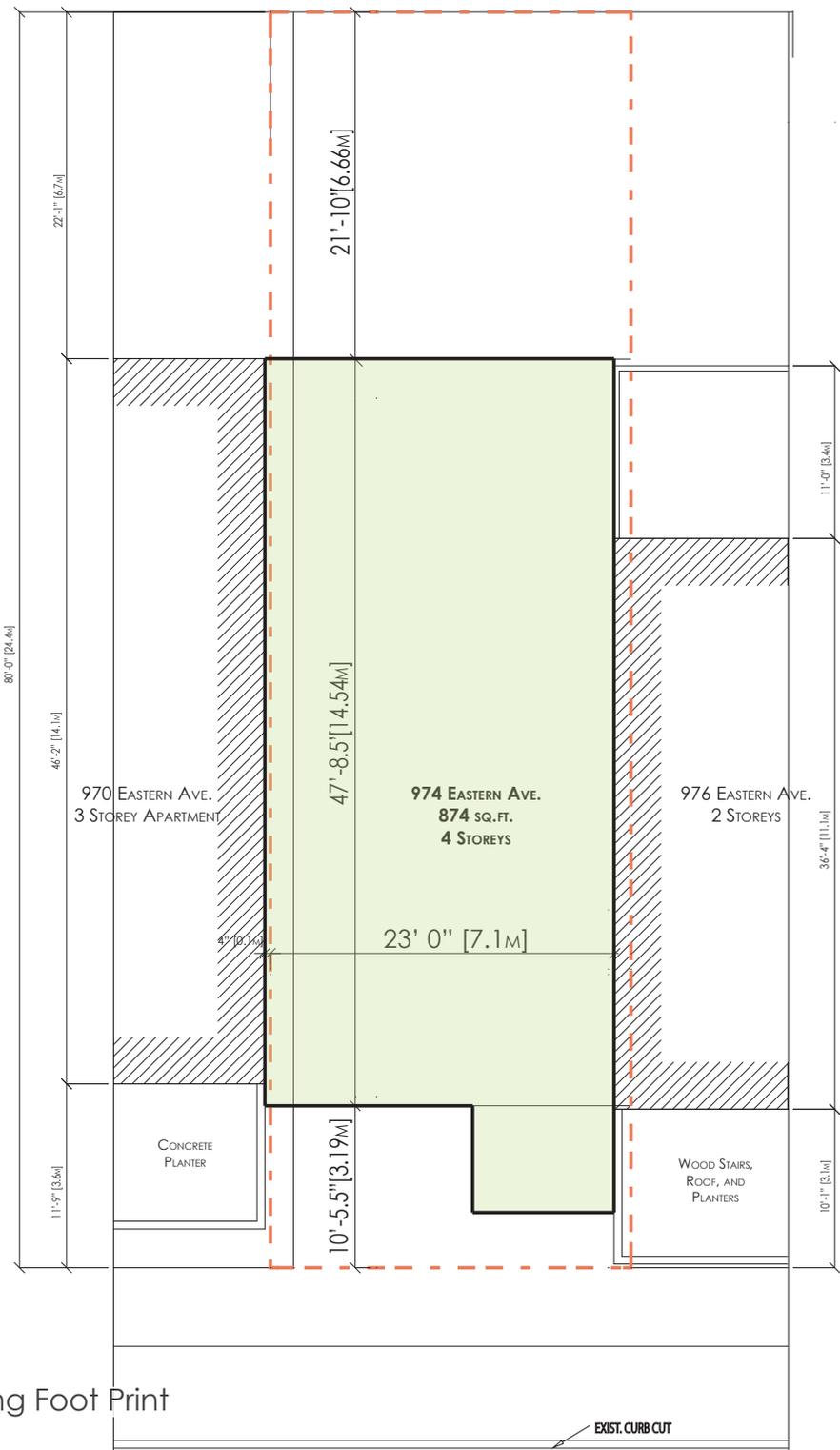
renewable energy

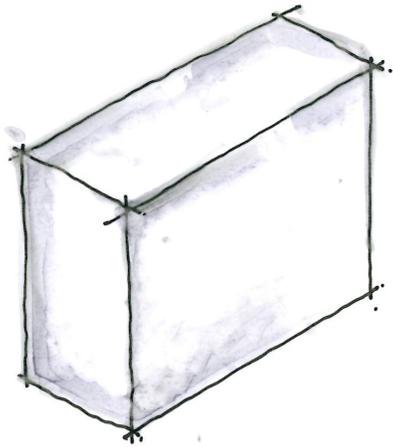
REDUCE
REUSE
RECYCLE

View looking North East

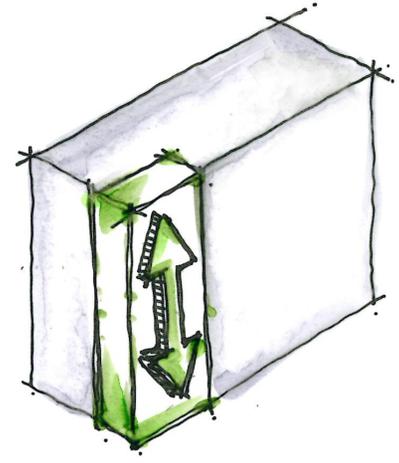


Building Foot Print

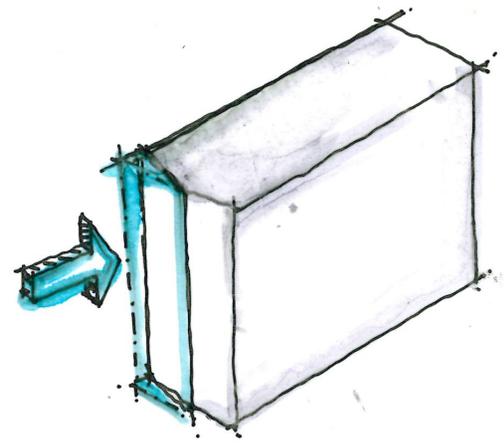




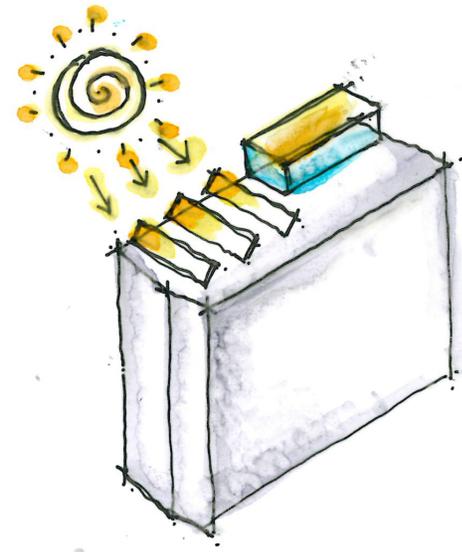
1. Efficient Box



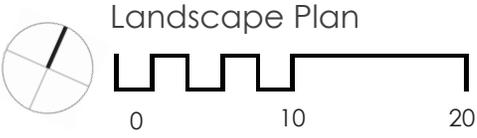
2. Vertical Circulation

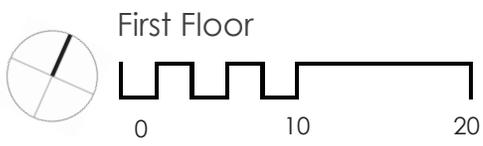
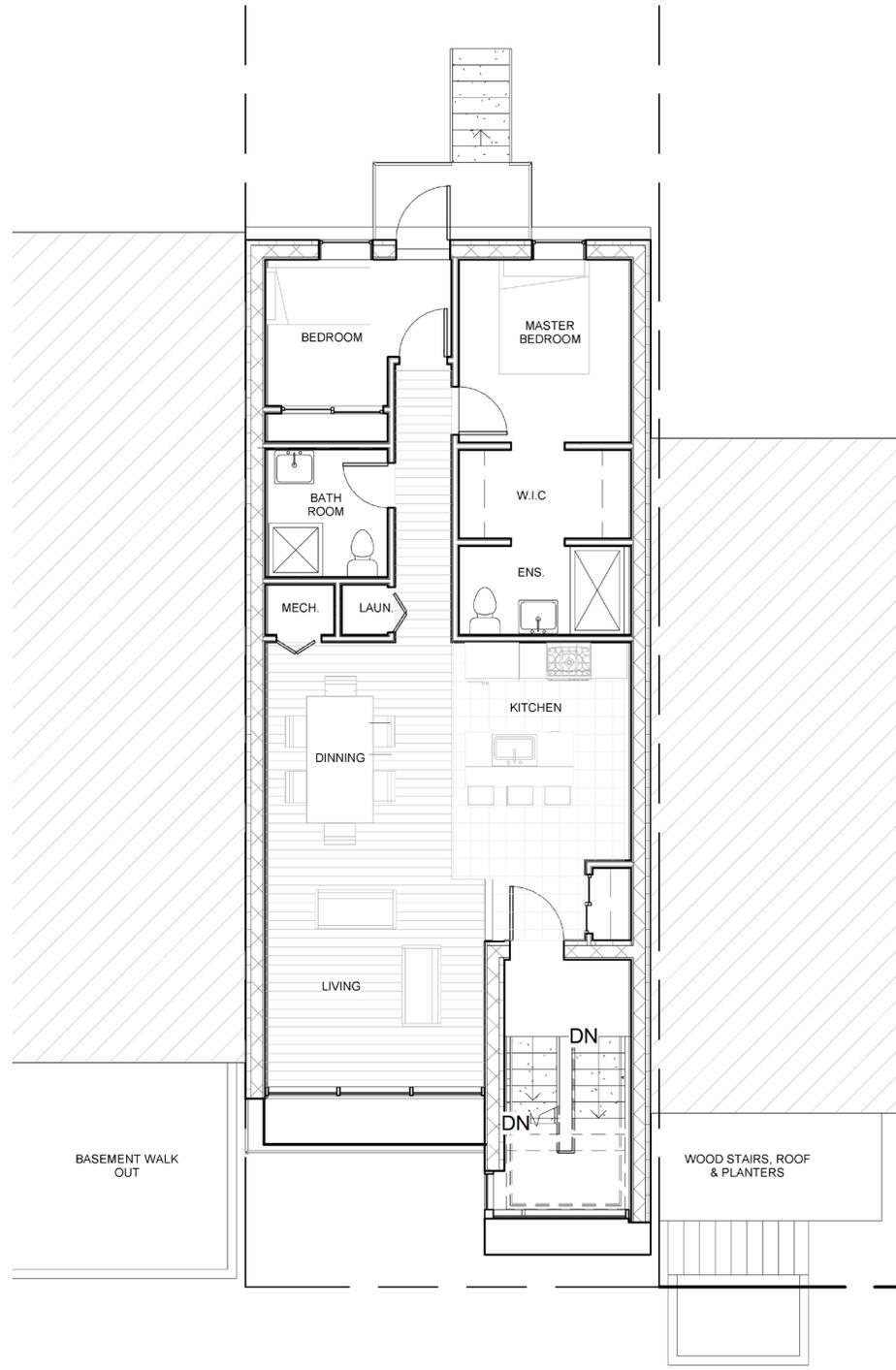


3. Tapered south facade for maximum exposure to light

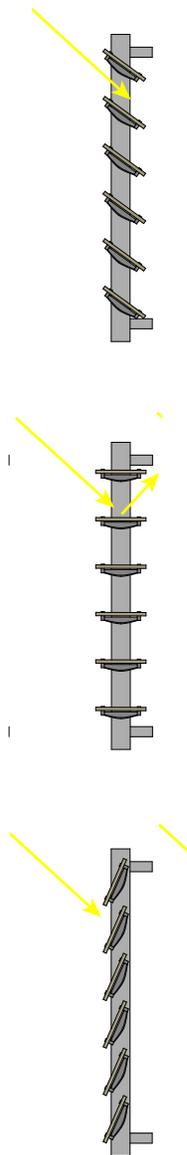
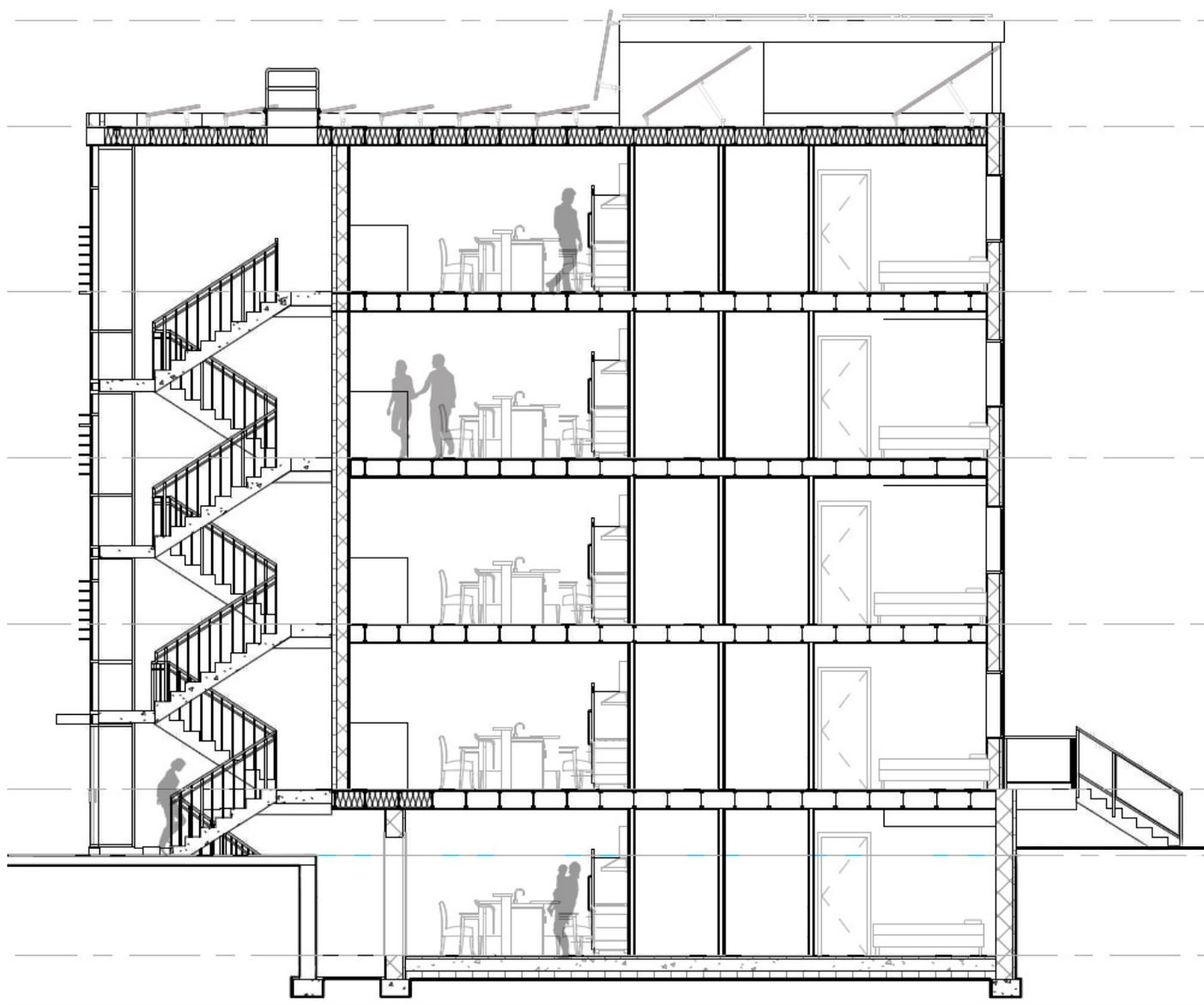


4. Renewable Energy

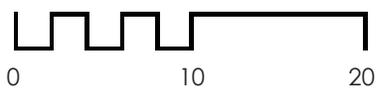


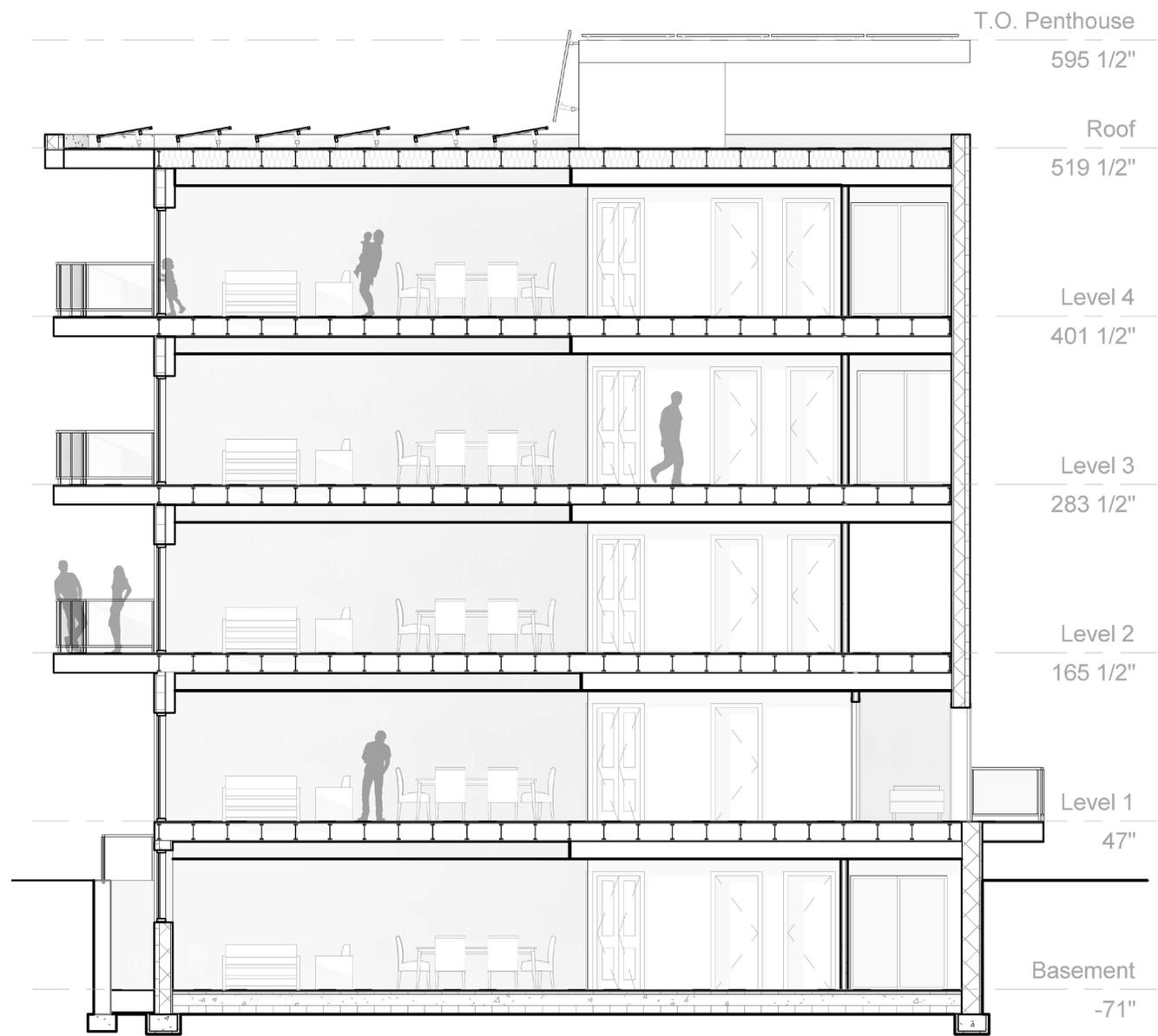


SIDEWALK

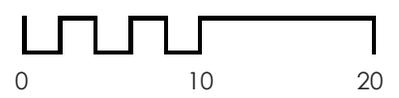


Section A





Section B

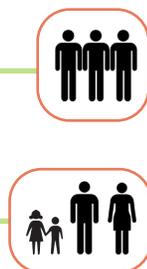




2 Bedroom



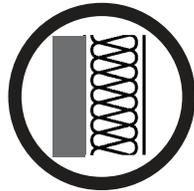
3 Bedroom



Living Space



ENVELOPE DURABILITY & ANALYSIS



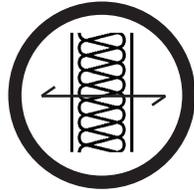
maximize **thermal resistance**



design for **optimal durability**



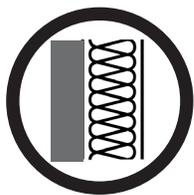
employ **rain shedding principles**



eliminate **thermal bridging**



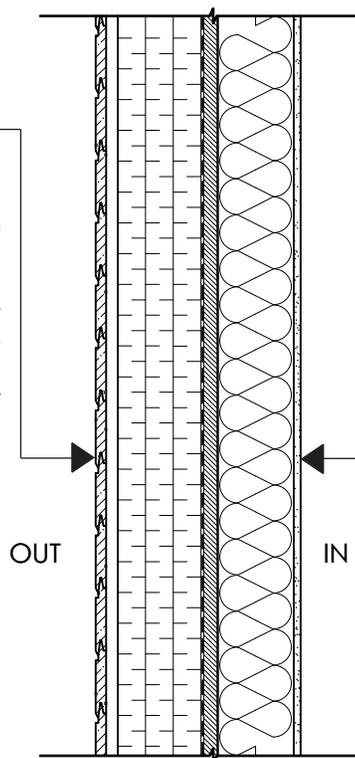
continuous **air tight envelope**



WALL SECTIONS

FROM OUTSIDE TO INSIDE

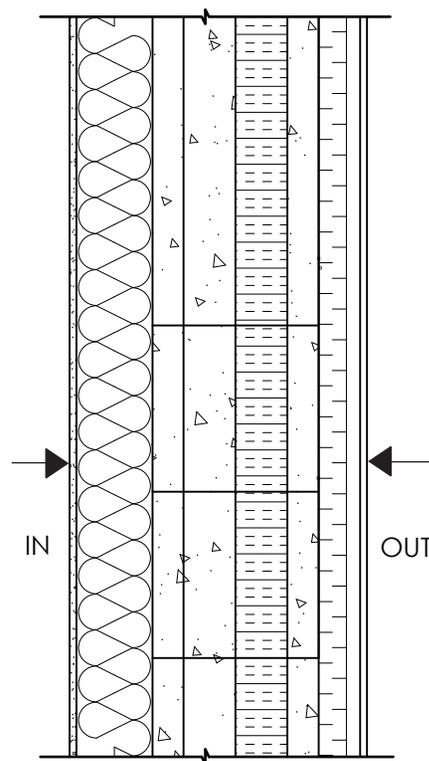
- 5/8" 'MAIBEC' WOOD SIDING
- 1" AIR CAVITY W/ FURRING STRIPS
- 6" XPS, TAPED AT JOINTS **R-30**
- 1" ZIP SHEATHING, CONTINUOUS **R-3**
- 2X6 WOOD STUD WALL
- 6" ROXUL MINERAL WOOL BATT **R-24**
- GYPSUM BOARD
- NON VOC PAINT



SOUTH / NORTH TYPICAL WALL SECTION.
EFFECTIVE **R-50**

FROM OUTSIDE TO INSIDE

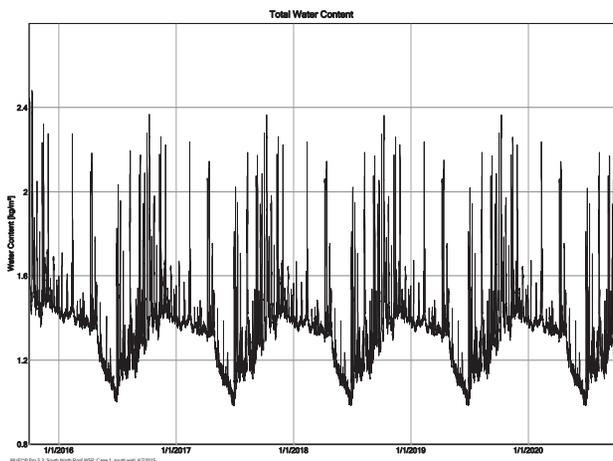
- 1/2" FIBRE CEMENT PANEL
- 1" AIR CAVITY W/ FURRING STRIPS
- 2" XPS, TAPED AT JOINTS **R-10**
- TYVEK COMMERCIAL WRAP
- 12" DURISOL R-14 ICF **R-14**
- 2X6 WOOD STUD WALL
- 6" ROXUL MINERAL WOOL BATT **R-24**
- GYPSUM BOARD
- NON VOC PAINT



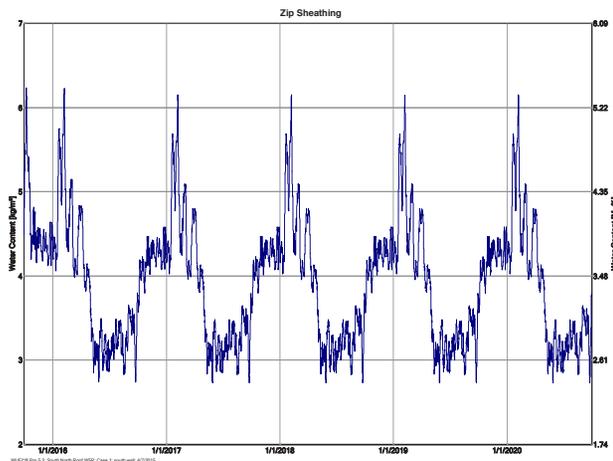
EAST / WEST TYPICAL WALL SECTION
EFFECTIVE **R-40**



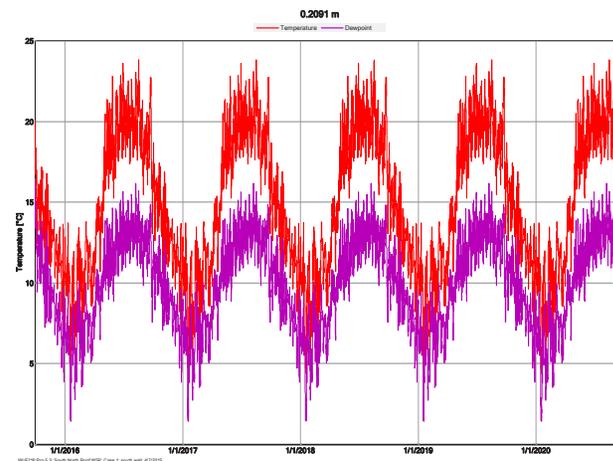
HYGROTHERMAL ANALYSIS



TOTAL WATER CONTENT



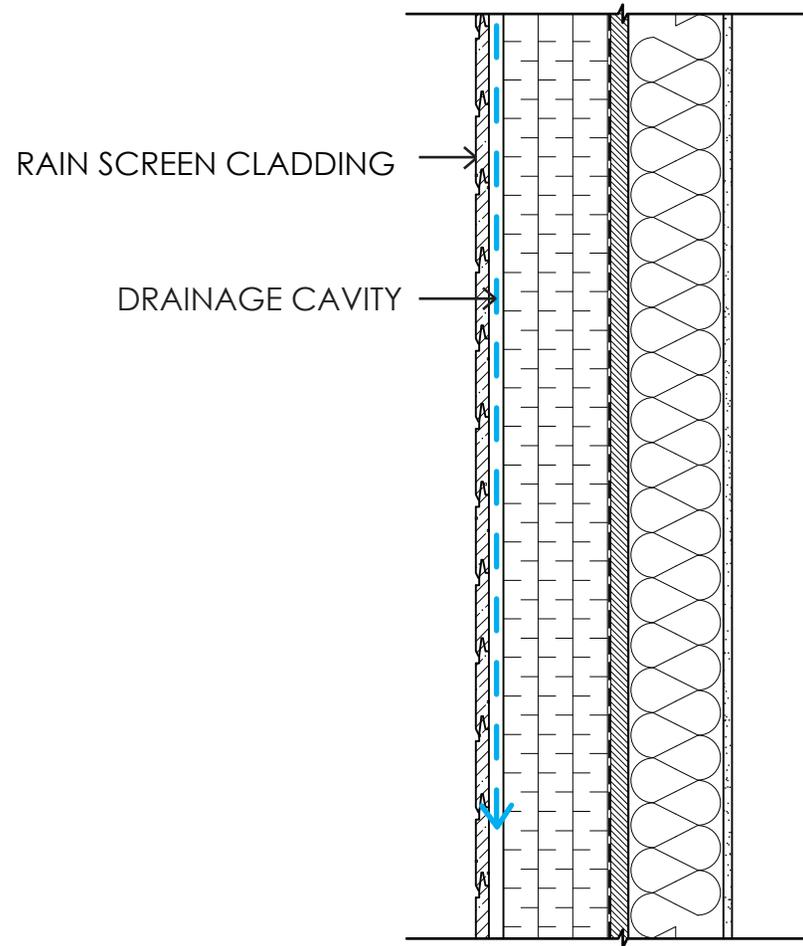
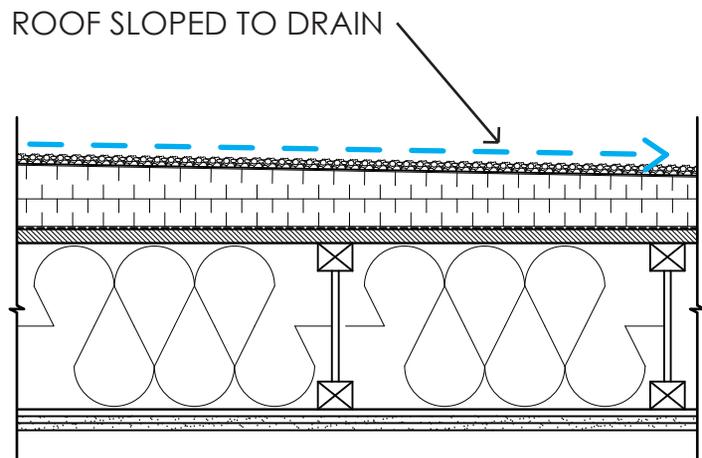
WATER CONTENT AT ZIP SHEATHING

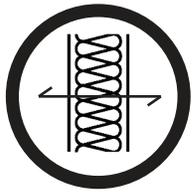


DEW POINT AT ZIP SHEATHING

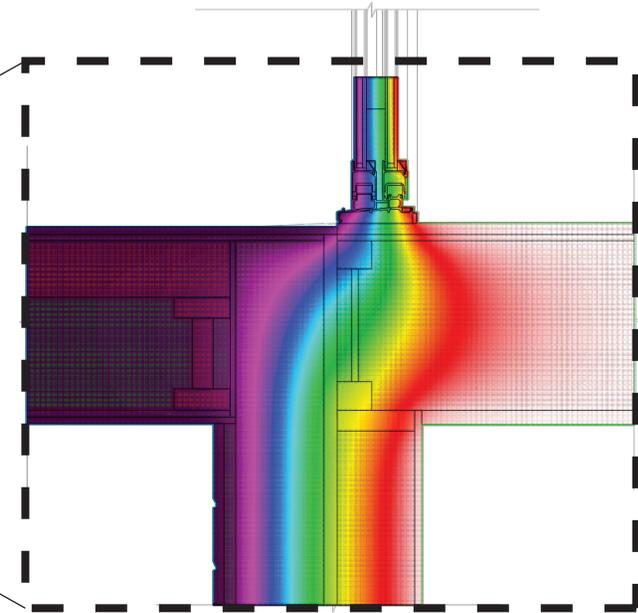
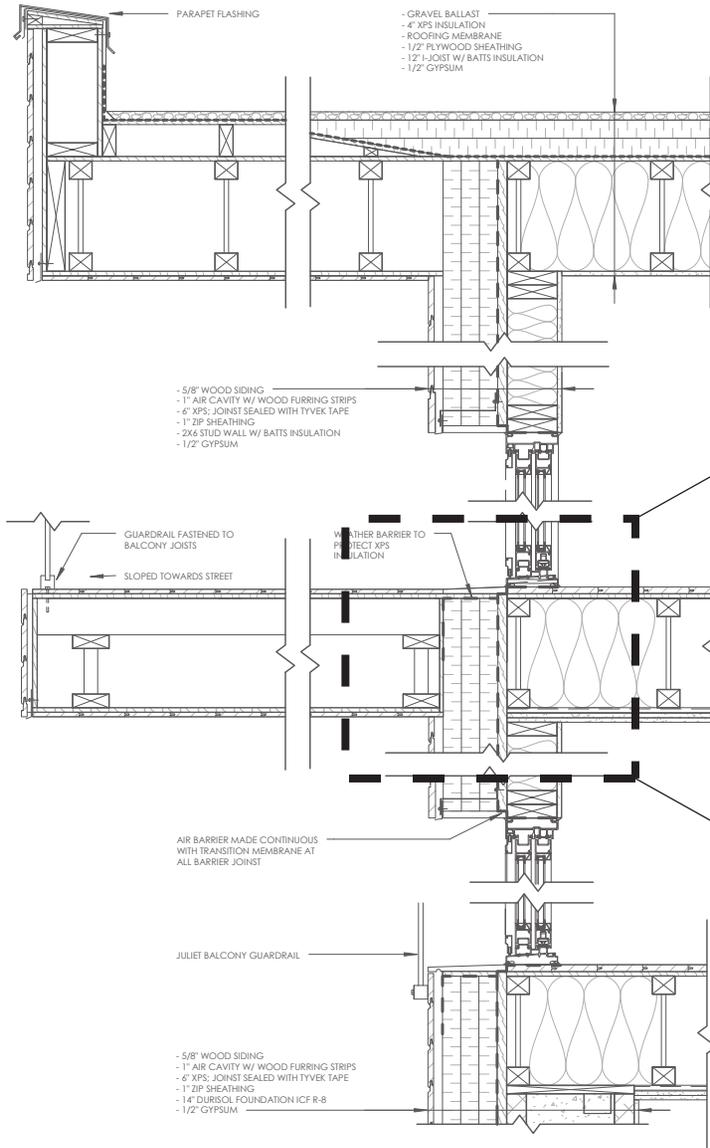


RAIN WATER SHEDDING





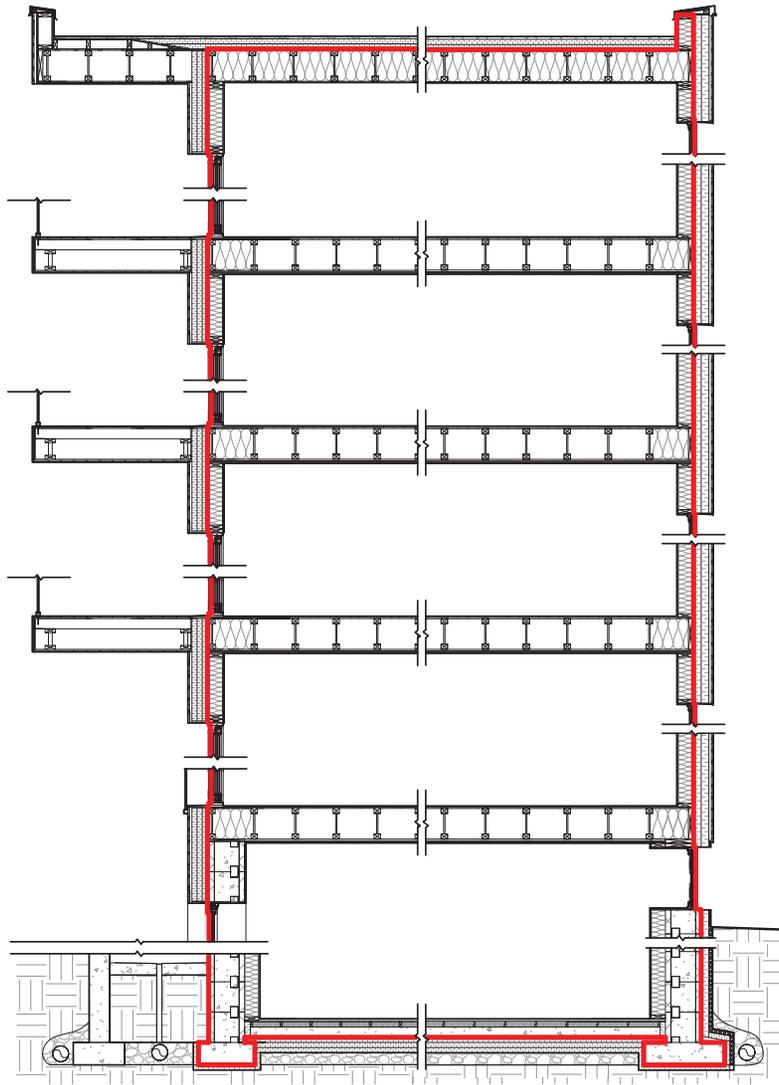
THERMAL BRIDGING CONTROL



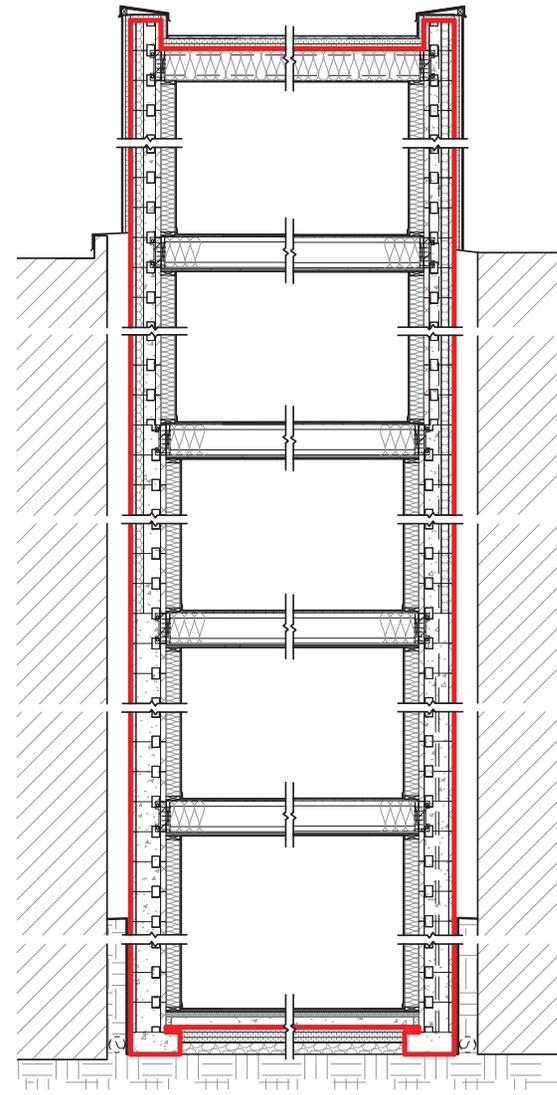
THERM ANALYSIS



AIR BARRIER CONTINUITY



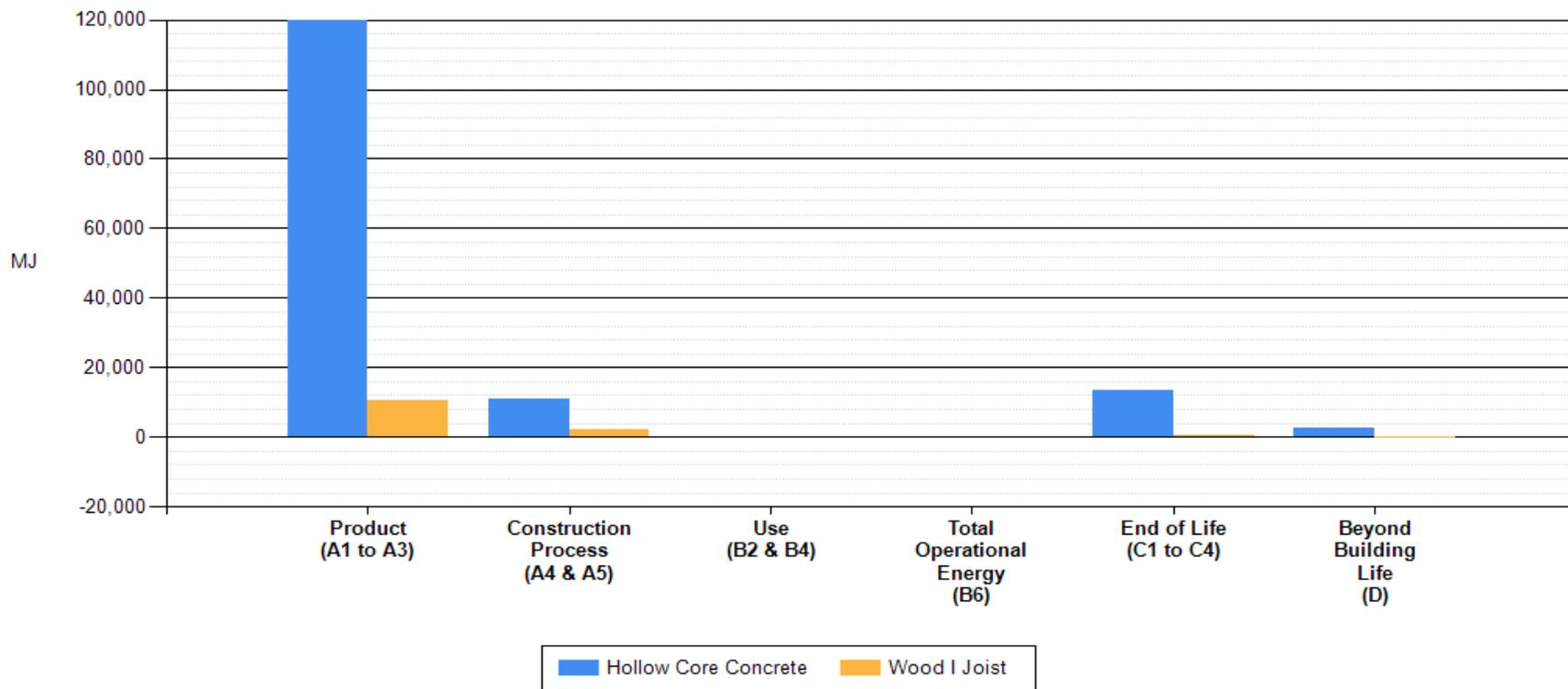
N-S AIR BARRIER SECTION



W-E AIR BARRIER SECTION

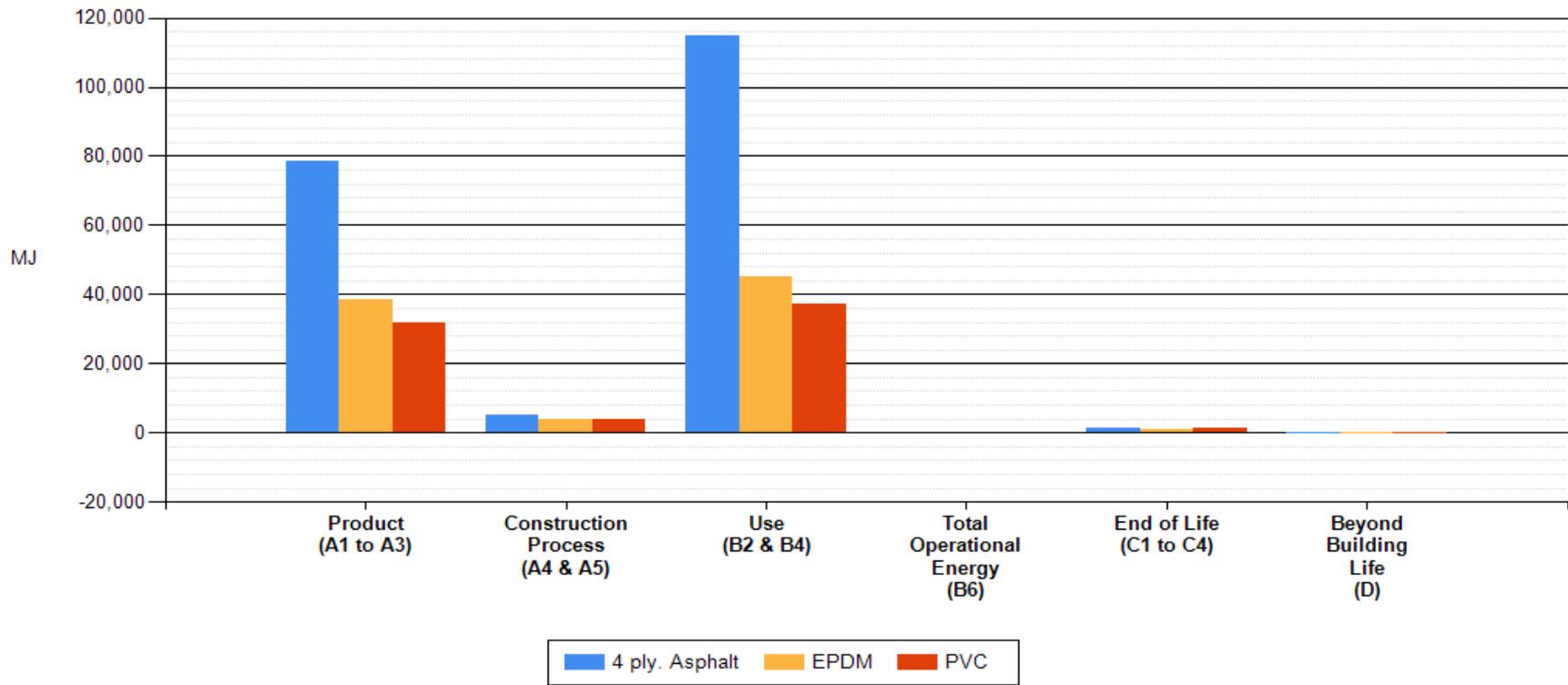


FLOOR CONSTRUCTION | PRIMARY ENERGY BY LIFE CYCLE STAGE





ROOFING MEMBRANE | PRIMARY ENERGY BY LIFE CYCLE STAGE



INDOOR AIR QUALITY



fresh air



building materials



CO² detectors



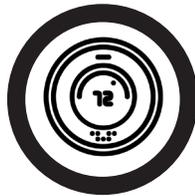
SPACE CONDITIONING STRATEGIES



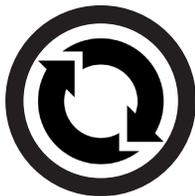
minimize operational cost



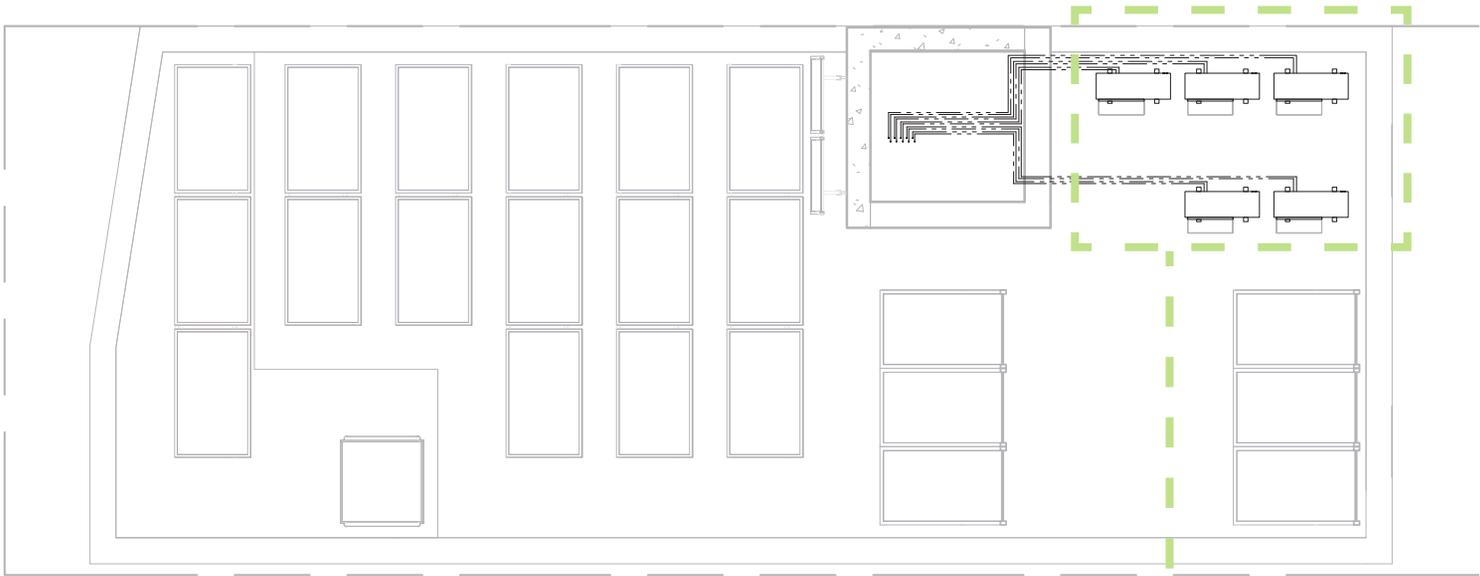
using a renewable energy source



appropriate size of mechanical system for thermal comfort

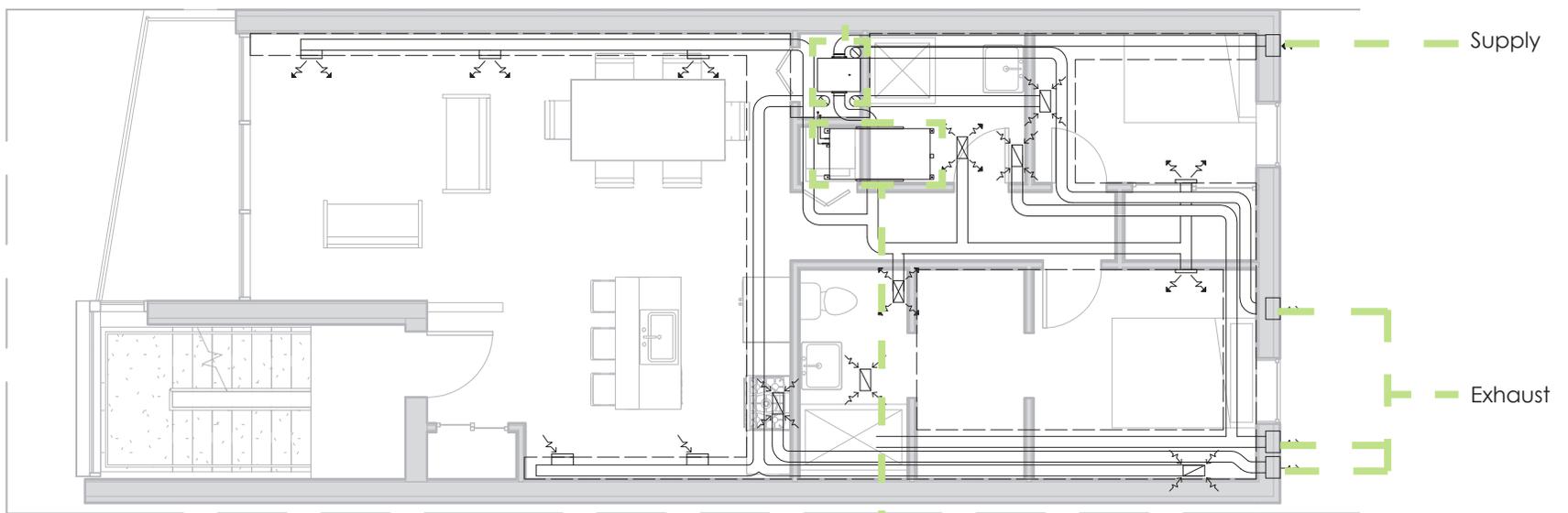


energy recovery in supply and exhaust air



ROOF HVAC UNIT LAYOUT

 
Mitsubishi ASHP
Outdoor Unit



TYPICAL HVAC LAYOUT

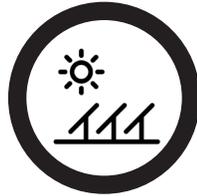


Supply

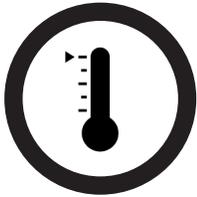
Exhaust



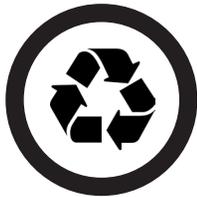
DOMESTIC WATER STRATEGIES



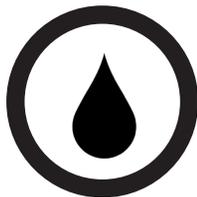
optimize solar thermal technology



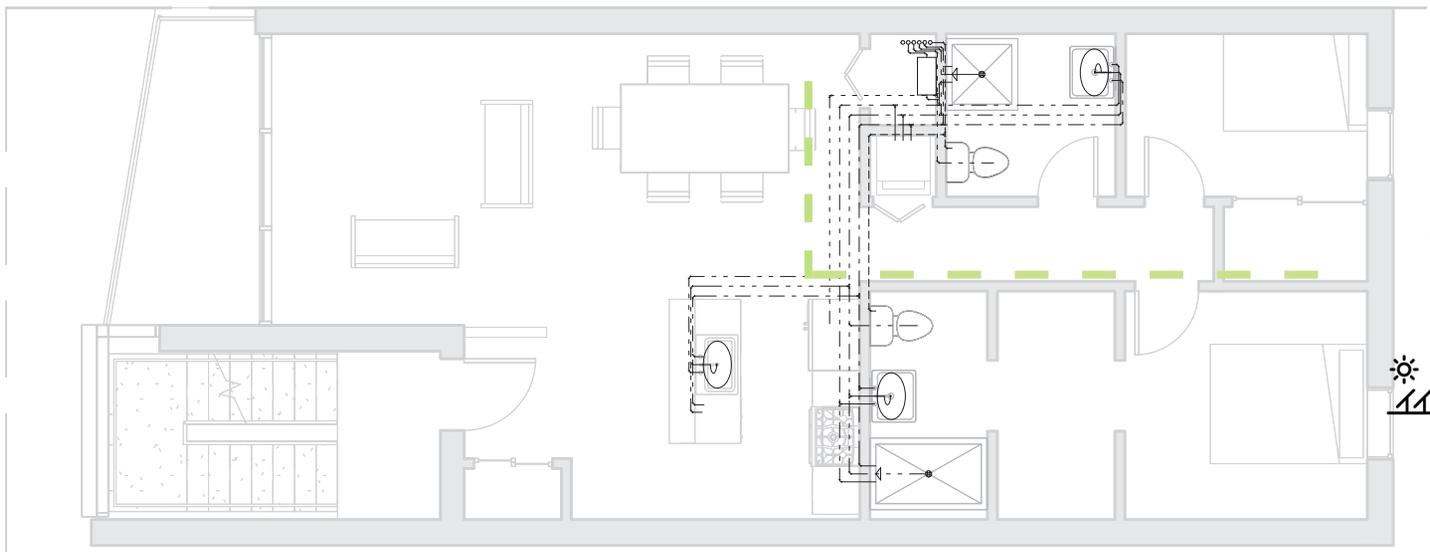
optimize end user experience



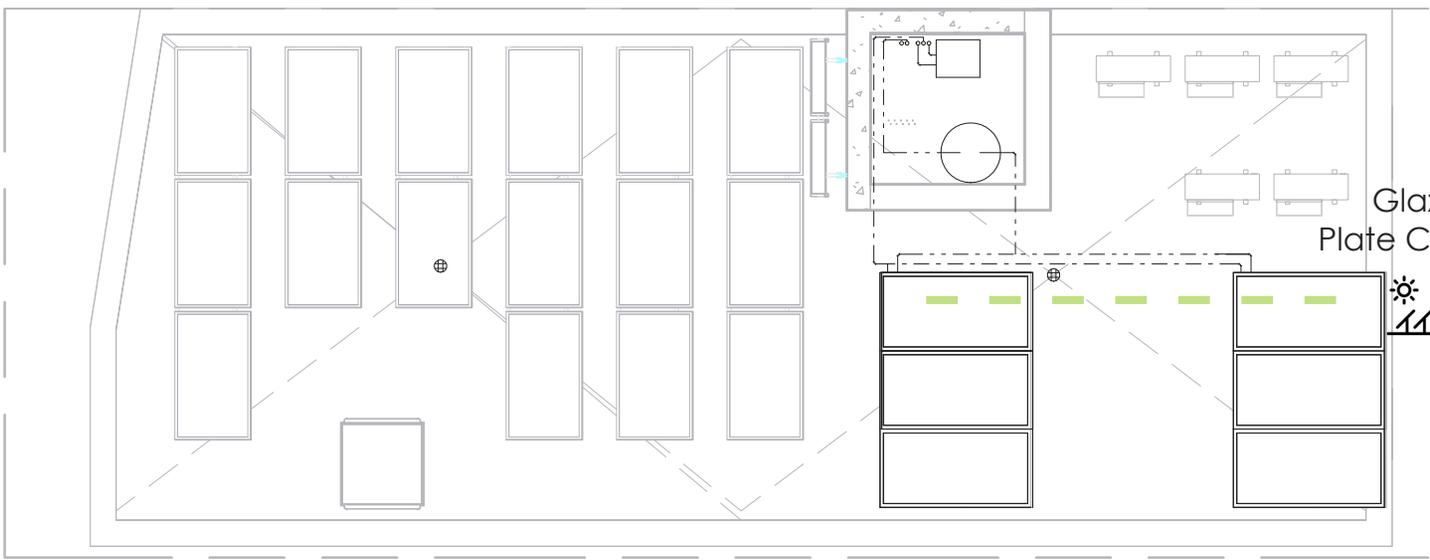
reuse greywater system



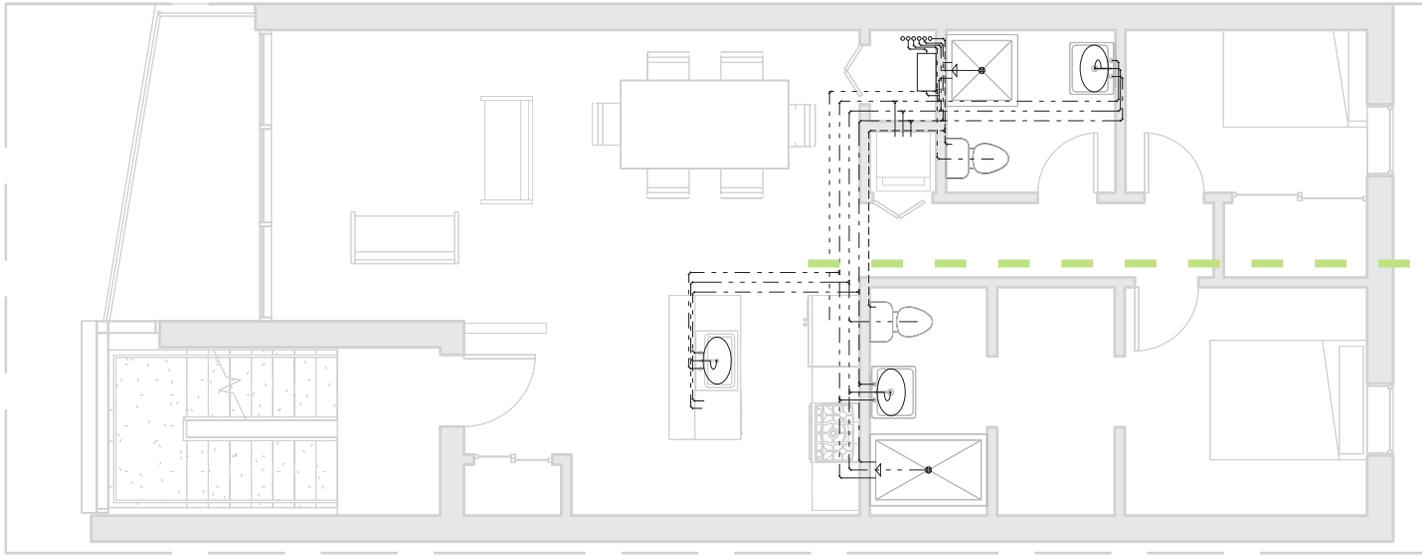
optimize water quality



TYPICAL PLUMBING PLAN



ROOF PLUMBING PLAN



TYPICAL PLUMBING PLAN

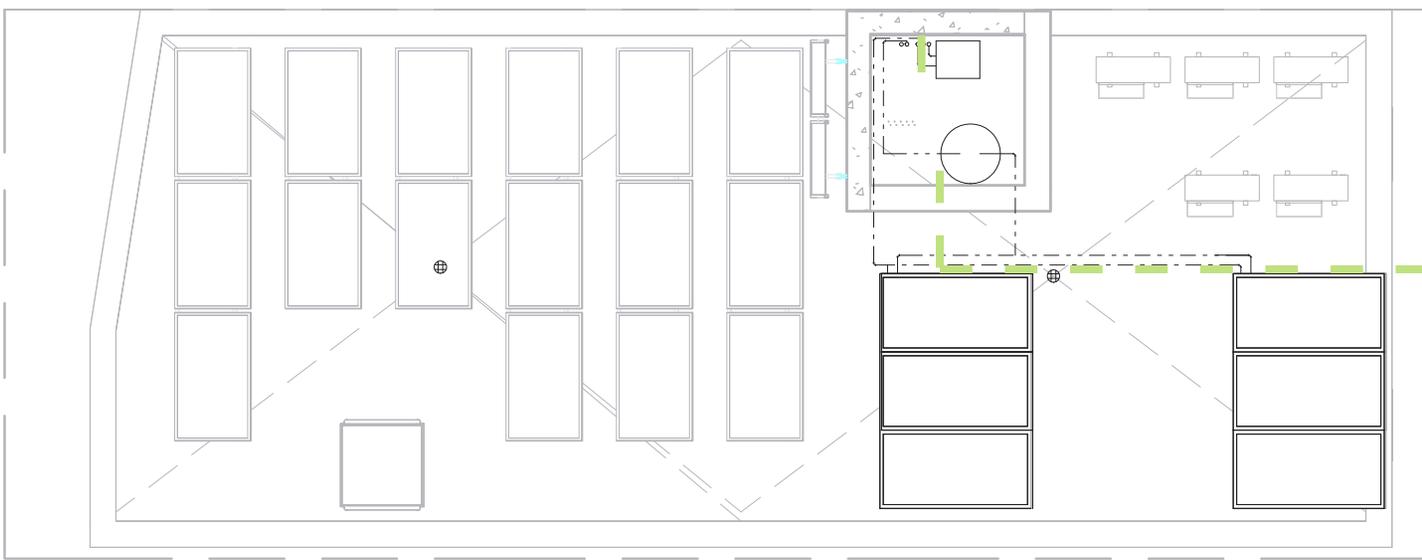
Insulated PEX Pipes



Greywater Recovery System



Insulated Hot Water Tank



ROOF PLUMBING PLAN

LIGHTING STRATEGIES



energy star rated **LED lighting**

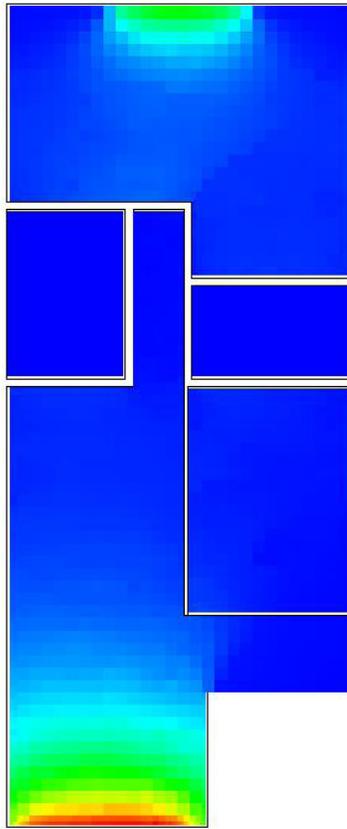


off - switch for **entire unit**

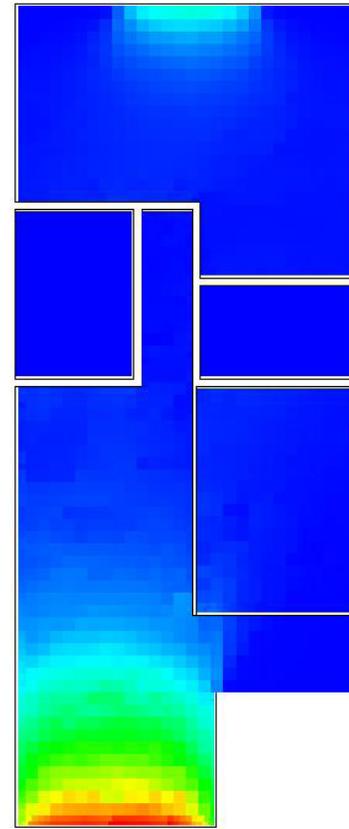
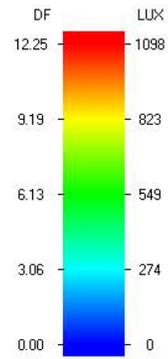


motion detectors turns lights off when no activity is present

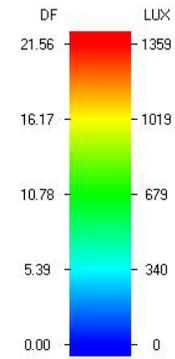
NATURAL LIGHT PENETRATION



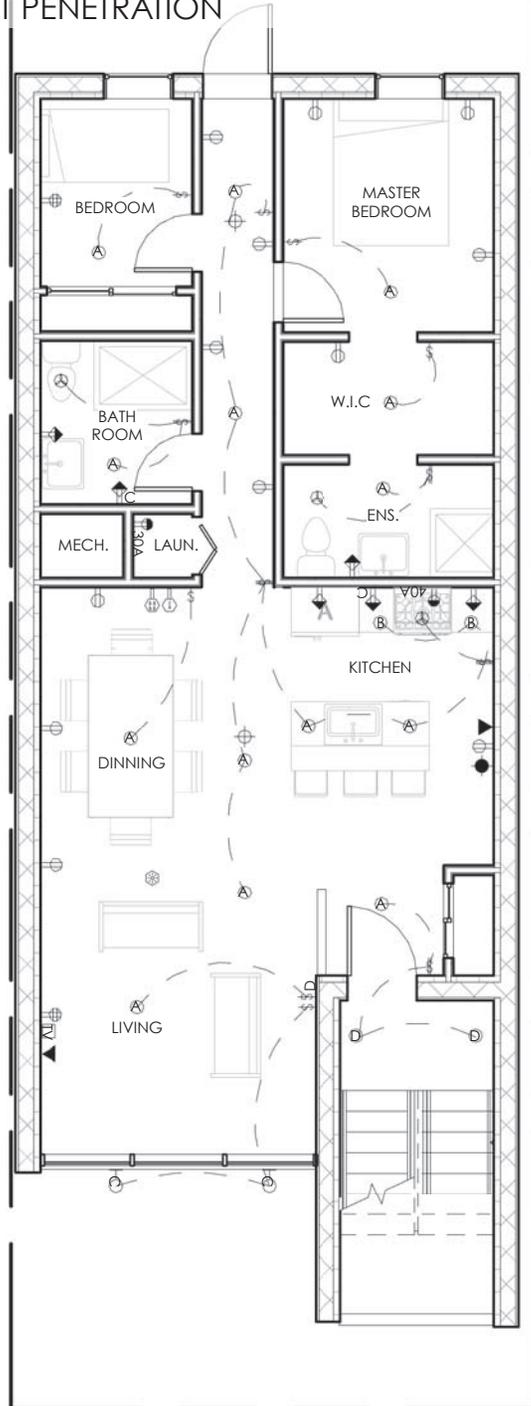
Summer



Winter



NATURAL LIGHT PENETRATION



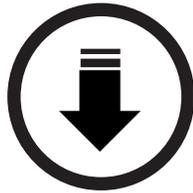
ELECTRICAL LEGEND

LIGHTING CONTROL	
\$\$\$	ONE, TWO, THREE, AND FOUR GANG ROCKER SWITCHES
\$3	3-WAY ROCKER SWITCH
\$D	DIMMER SWITCH
\$OC	OCCUPANCY SENSOR SWITCH
\$M	MASTER SWITCH
— — —	WIRES FOR LIGHT CONTROL
MECHANICAL CONTROL	
⊗	EXHAUST FAN
ELECTRIC POWER	
⊕	15A, U-GROUND DUPLEX RECEPTACLE @ 1'-6" AFF
⊕	15A, U-GROUND QUAD RECEPTACLE @ 1'-6" AFF
⊕	15A, GFCI DUPLEX RECEPTACLE @ 1'-6" AFF
⊕	15A, GFCI DUPLEX RECEPTACLE @ 4'-0" AFF
⊕ 30A	220V, 30-AMP DRYER OUTLET
⊕ 40A	220V, 40-AMP RANGE OUTLET
LIGHT FIXTURES	
Ⓐ	CEILING MOUNTED LUMINAIRE w/ INDIRECT LIGHT (w/ 2W LED BULB)
Ⓑ	UNDER CABINET LUMINAIRE w/ DIRECT LIGHT (w/ 4W LED BULB)
Ⓒ	OUTDOOR CEILING MOUNTED LUMINAIRE w/ INDIRECT LIGHT (w/ 4W LED BULB)
Ⓓ	OUTDOOR CEILING MOUNTED LUMINAIRE w/ DIRECT LIGHT (w/ 2W LED BULB)
⊥Ⓐ	WALL SCONCE w/ INDIRECT WALL WASH LIGHT (w/ 4W LED BULB)
⊥Ⓑ	WALL SCONCE w/ DIRECT LIGHT (w/ 4W LED BULB)
⊥Ⓒ	OUTDOOR WALL SCONCE w/ INDIRECT WALL WASH LIGHT (w/ 4W LED BULB)
⊙CF	CEILING FAN w/ INDIRECT LIGHT (w/ 2W LED BULB)
SENSORS	
⊥	TEMPERATURE SENSOR
⊥	HUMIDITY SENSOR
⊕	DAYLIGHT SENSOR
⊕	SMOKE DETECTOR
●	CARBON MONOXIDE DETECTOR
COMMUNICATION	
▼	PHONE OUTLET
TV	TELEVISION OUTLET

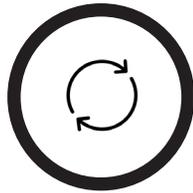
ENERGY MODELING & ANALYSIS



informative design decisions



reduce energy consumption



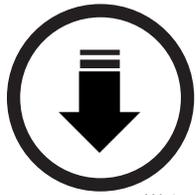
reuse energy



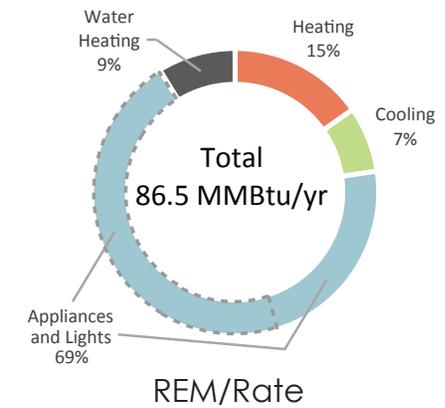
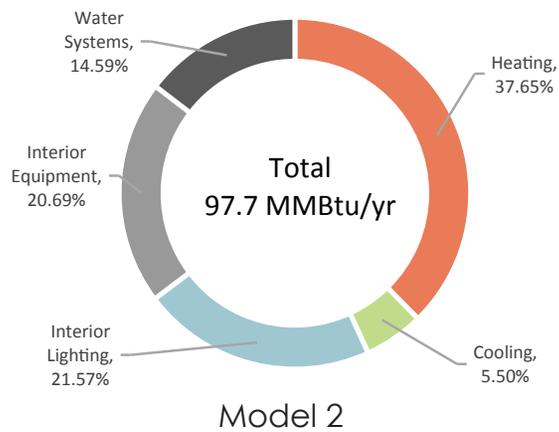
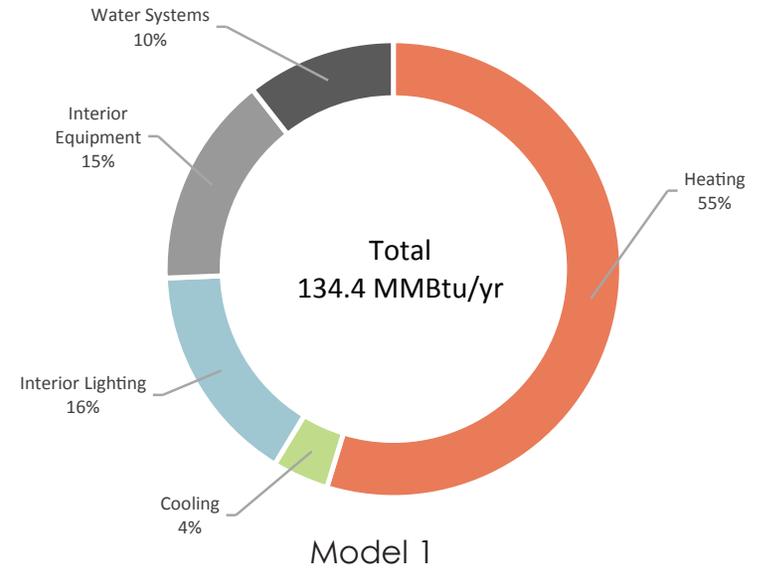
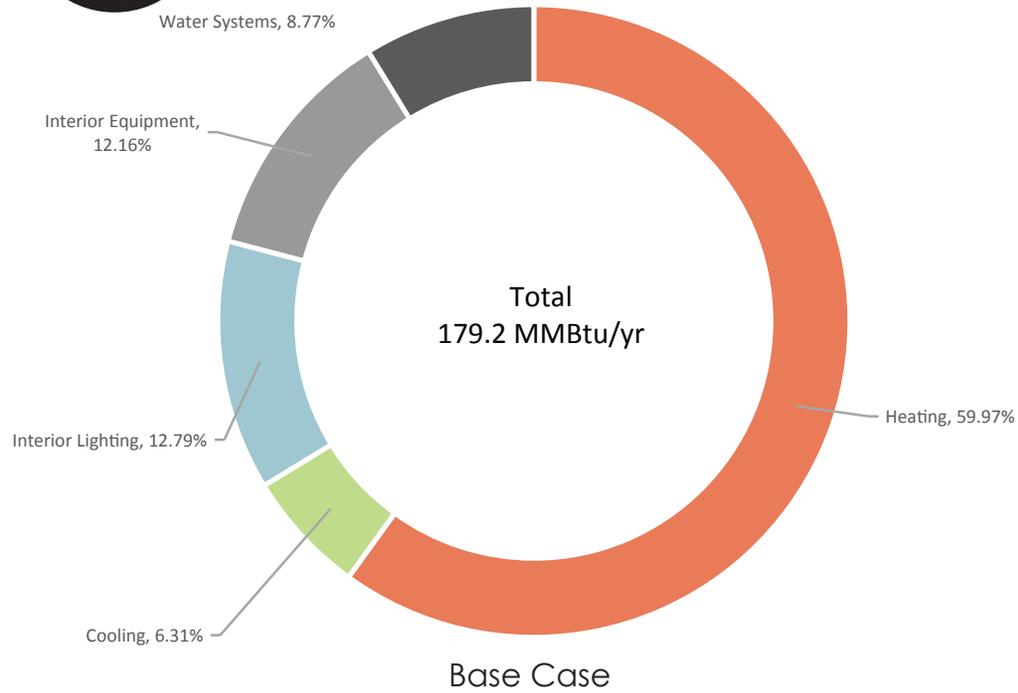
ENERGY MODELING PROCESS

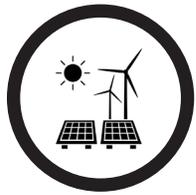
	Nominal R-Value	HVAC	Ventilation	Set Point Temperature
Design Builder Base Case	R-27 walls, R-30 Roof OBC Code Required	Fan Coil Unit	Mechanical	Heating - 23 Cooling - 24
Design Builder Design Conditions [Model 1]	R-50, Walls and Roof, Passive House Standard	Fan Coil Unit	Mechanical, Heat Recovery, Natural Ventilation (Shoulder Seasons)	Heating - 21 Setback - 18 Cooling - 25 Setback - 28
Design Builder [Model 2]	R-50, Walls and Roof, Passive House Standard	Estimate Reductions Based off increased COP	Mechanical, Heat Recovery, Natural Ventilation (Shoulder Seasons)	Heating - 21 Setback - 18 Cooling - 25 Setback - 28
REM/Rate 14.6	R-50, Walls and Roof, Passive House Standard	Air Source Heat Pump	Mechanical, Heat Recovery, Natural Ventilation (Shoulder Seasons)	n/a

Annual Consumption (MMBtu/yr)	Heating	Cooling	Water Heating	Lighting	Appliances	Photovoltaics	Total
Design Builder Base Case	107.5	11.3	15.7	22.9	21.8	n/a	179.2
Design Builder Design Conditions [Model 1]	73.5	5.4	14.2	21.1	20.2	n/a	134.4
Design Builder [Model 2]	36.8	5.4	14.2	21.1	20.2	n/a	97.7
REM/Rate 14.6	13.2	6.4	7.6		59.3	-26.6	86.5
						Reduction	45.5%
						Difference	13%



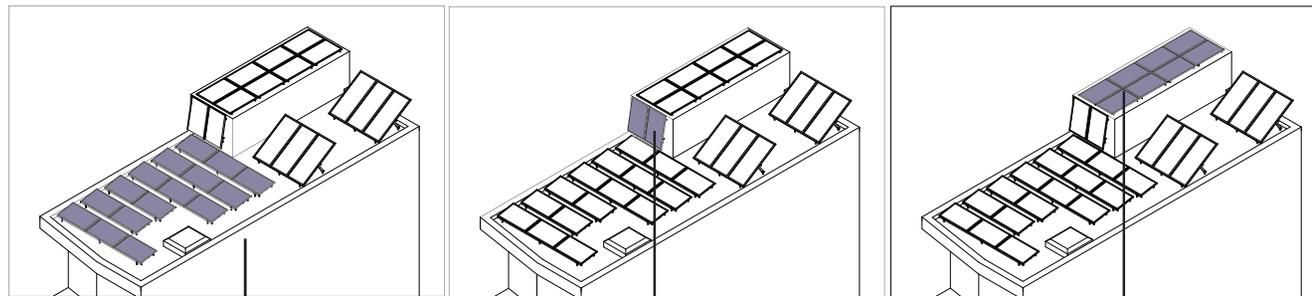
ENERGY REDUCTION





RENEWABLE HARVESTING

	# of Panels	Tilt angle (x°)	Area (m ²)	Area (ft ²)	Efficiency	Array Peak Power (kW)	Generation (kWh/yr)
	16	10	25.73	277	16.5%	4.245	5386
	2	80	3.2	34.5	16.5%	0.528	522
	8	0	12.86	138.5	16.5%	2.120	2349
Totals	26	n/a	41.79	450	16.5%	6.893	8257



16 panels mounted at 10 degrees

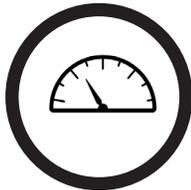
2 panels wall mounted at 80 degrees

8 panels mounted at 0 degrees

FINANCIAL ANALYSIS



overall **affordability** for average income citizens



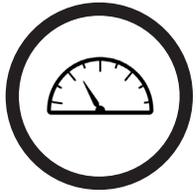
high **performance** materials



minimize **operation cost**

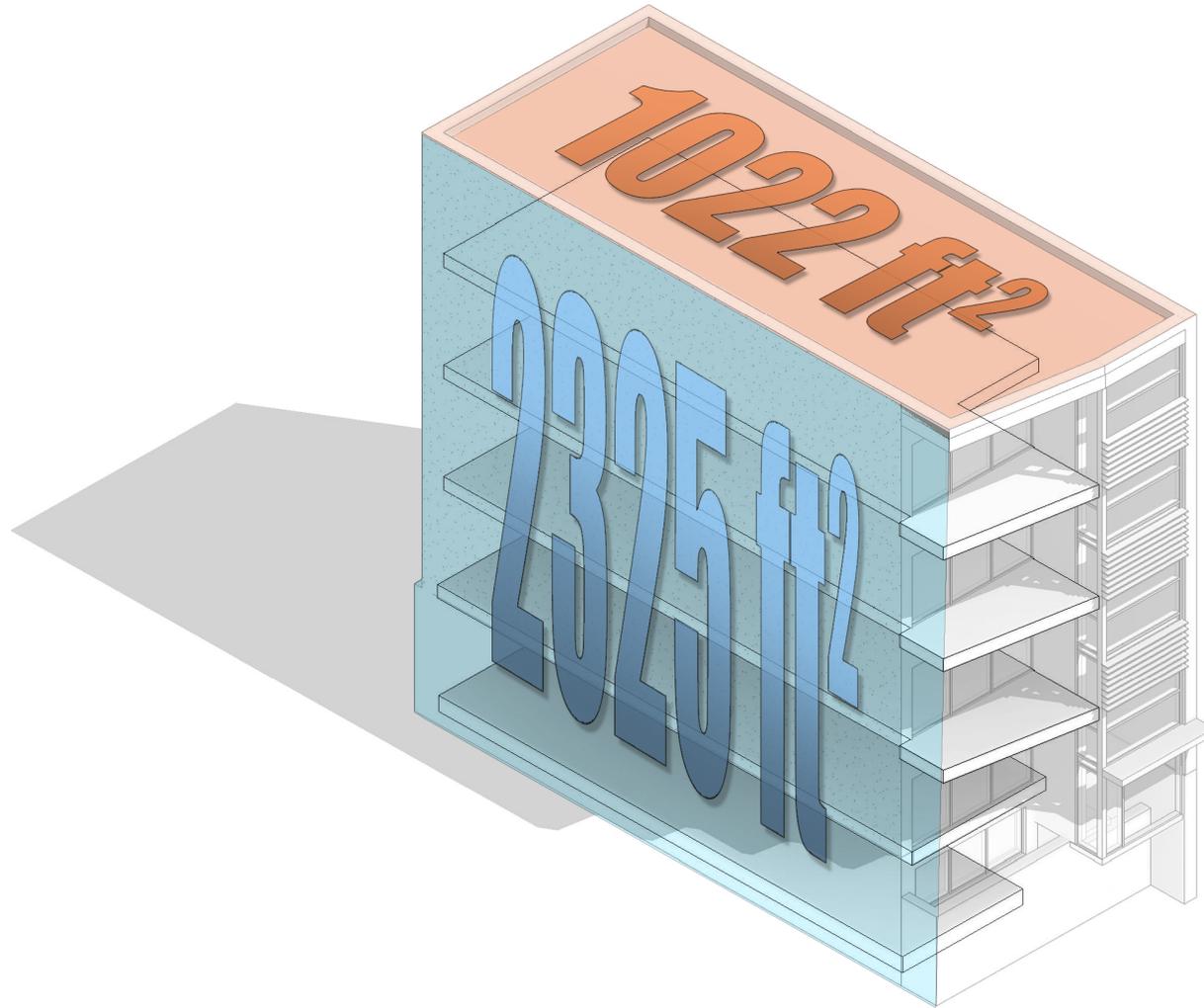


feasible for investors



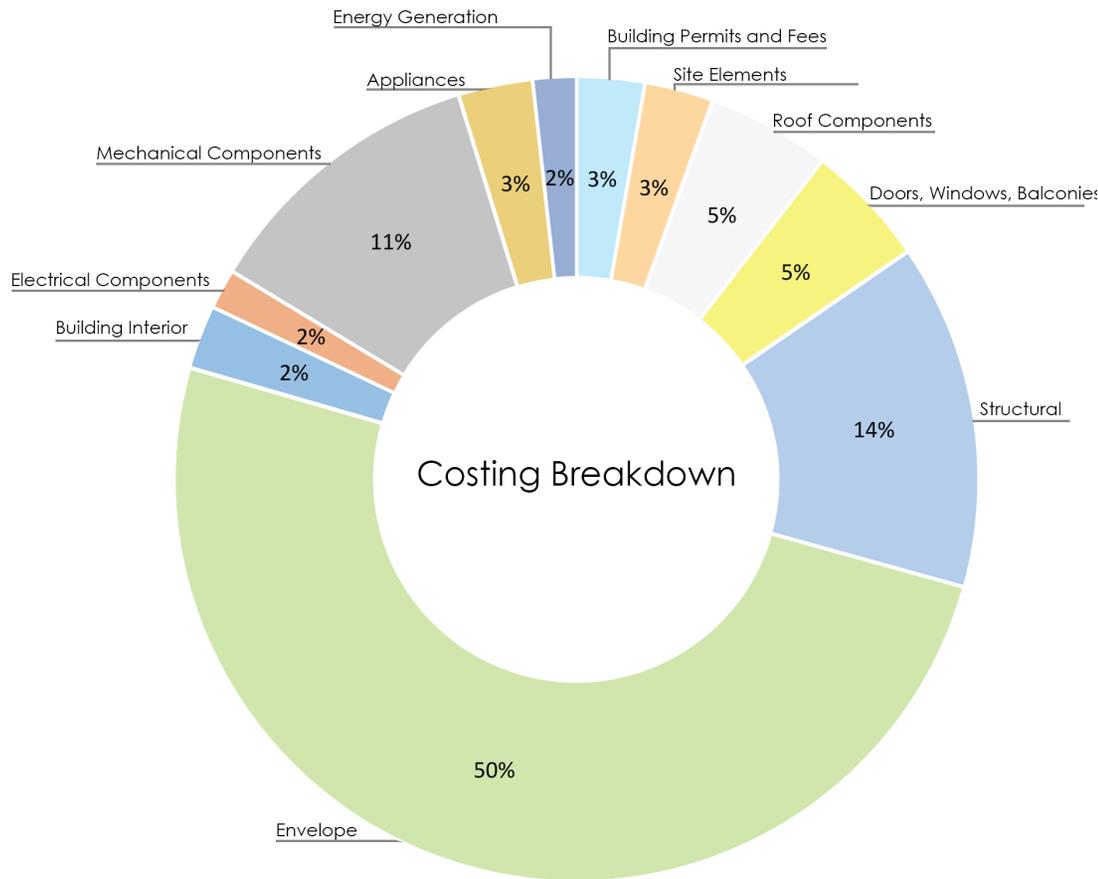
HIGH WALL AREAS = HIGH PERFORMING INSULATION TO PREVENT HEAT LOSS

HIGH PERFORMING INSULATION = HIGH INITIAL COST IN RETURN FOR LOW OPERATIONS





COST BREAKDOWN



Per FT²

\$125

4
Levels
and
1
Basement

1022
FT² Per Level

\$640730
Total Construction Cost



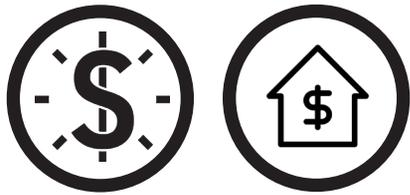
BASE CASE vs. Ø-ZONE

Initial Construction Cost

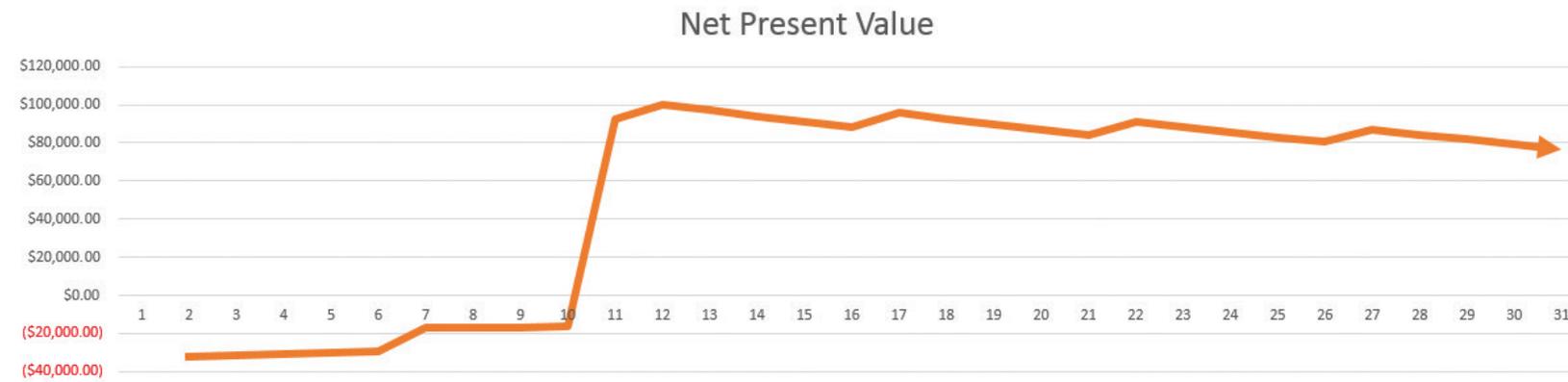


Annual Operations Cost





LIFE CYCLE COST ANALYSIS



Internal Rate of Return - **21.19 %**

Net Profit - **\$3,109,818**

Living Space



